SECTION I

RADIOLOGICAL EFFLUENT

MONITORING MANUAL

FOR THE
MILLSTONE NUCLEAR POWER STATION
UNIT NOs. 1, 2, & 3

DOCKET NOs. 50-245, 50-336, 50-423

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MILLSTONE STATION

RADIOLOGICAL EFFLUENT MONITORING MANUAL

TABLE OF CONTENTS

SECTION	PAGE NO.	REV. NO.	DATE
A. INTRODUCTION	A-1	3	12/1/94
B. RESPONSIBILITIES	B-1	5	11/18/99
C. LIQUID EFFLUENTS			
C.1 LIQUID EFFLUENTS SAMPLING AND ANALYSIS PROGRAM	C-1	3	11/18/99
	C-2	4	11/18/99
	C-3	5	11/18/99
	C-4	4	11/18/99
	C-5	4	11/18/99
	C-6	4	11/18/99
	C-7	5	11/18/99
	C-8	6	11/18/99
	C-9	4	11/18/99
	C-10	5	11/18/99
C.2 LIQUID RADIOACTIVE WASTE TREATMENT	C-11	7	11/18/99
	C-12	0	11/18/99
D. GASEOUS EFFLUENTS			
D.1 GASEOUS EFFLUENTS SAMPLING AND ANALYSIS PROGRAM	D-1	3	11/15/99
	D-2	4	11/18/99
	D-3	6	11/18/99
	D-4	4	11/18/99
	D-5	5	11/18/99
	D-6	3	11/18/99
	D-7	4	11/18/99
	D-8	5	11/18/99
D.2 GASEOUS RADIOACTIVE WASTE TREATMENT	D-9	5	11/18/99

SECTION	PAGE NO.	REV. NO.	DATE
E. RADIOLOGICAL ENVIRONMENTAL MONITORING			
E.1 SAMPLING AND ANALYSIS	E-1	6	5/30/97
	E-2	7	11/15/99
	E-3	9	11/18/99
	E-4	7	11/18/99
	E-5	6	11/18/99
	E-6	6	11/18/99
E.2 LAND USE CENSUS	E-7	7	11/18/99
E.3 INTERLABORATORY COMPARISON PROGRAM	E-8	6	5/30/97
F. REPORT CONTENT			
F.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT	F-1	4	11/9/98
F.2 ANNUAL RADIOACTIVE EFFLUENT REPORT	F-2	5	11/18/99

A. INTRODUCTION

The purpose of this manual is to provide the sampling and analysis programs which provide input to the ODCM for calculating liquid and gaseous effluent concentrations and offsite doses. Guidelines are provided for operating radioactive waste treatment systems in order that offsite doses are kept As-Low-As-Reasonably-Achievable (ALARA).

The *Radiological Environmental Monitoring Program* outlined within this manual provides confirmation that the measurable concentrations of radioactive material released as a result of operations at the Millstone Site are not higher than expected.

In addition, this manual outlines the information required to be submitted to the NRC in both the *Annual Radiological Environmental Operating Report* and the *Annual Radioactive Effluent Report.*

B. RESPONSIBILITIES

All changes to this manual shall be reviewed and approved by the Site Operations Review Committee prior to implementation.

All changes and their rationale shall be documented in the *Annual Radioactive Effluent Report.*

It shall be the responsibility of the Senior Vice President and CNO - Millstone to ensure that this manual is used in performance of the applicable surveillance requirements and administrative controls of the *Technical Specifications for Millstone Units 2 and 3.*

C. LIQUID EFFLUENTS

C.1 Liquid Effluent Sampling and Analysis Program

Radioactive liquid wastes shall be sampled and analyzed in accordance with the program specified in **Table C-1** for Millstone Unit No. 1, **Table C-2** for Millstone Unit No. 2, and **Table C-3** for Millstone Unit No. 3. The results of the radioactive analyses shall be input to the methodology of the ODCM to assure that the concentrations at the point of release are maintained within the limits of *Radiological Effluent Control (Section III) D.1.1* for Millstone Unit No. 1 and within *Technical Specification 3.11.1* for Millstone Unit Nos. 2 and 3.

Table C-1

MILLSTONE 1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Batch Release[B] Waste Sample Tanks, Floor Drain Sample Tank and Decontamination Solution Tank	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
	Prior to Each Batch	Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
	Prior to Each Batch	Quarterly Composite[E]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release Reactor Building Service Water	Weekly Grab Sample[D]	Weekly Composite[E]	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
	Weekly Grab or Composite[E]	Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha[F]	1×10^{-7}
	Weekly Composite[E,F]	Quarterly Composite[E,F]	Sr-89[F], Sr-90[F]	5×10^{-8}
			Fe-55[F]	1×10^{-6}

TABLE C-1 (Cont'd.)

TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as μCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided.

C. The LLD will be 5×10^{-7} μCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall be measured, but with an LLD of 5×10^{-6} uCi/ml.

This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified

TABLE C-1 (Cont'd.)

and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

D. If a weekly sample identifies the presence of gamma activity greater than or equal to 5×10^{-7} uCi/ml, sample frequency shall be increased to daily until the gamma activity is less than 5×10^{-7} uCi/ml. Daily grab samples shall be taken at least five days per week.

E. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

F. These analyses are only required if a weekly gamma analysis indicates a gamma activity greater than 5×10^{-7} µCi/ml.

G. LLD applies exclusively to the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

Table C-2

MILLSTONE 2

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Batch Release[B]				
1. Coolant Waste Monitor Tank, Aerated Waste Monitor Tank and Steam Generator Bulk	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
			Dissolved and Entrained Gases[K]	1×10^{-5}
2. Condensate Polishing Facility - Waste Neutralization Sump[E]	Prior to Each Batch	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[D]	1×10^{-7}
	Prior to Each Batch	Quarterly Composite[F,G]	Sr-89[D], Sr-90[D]	5×10^{-8}
			Fe-55[D]	1×10^{-6}
B. Continuous Release				
1. Steam Generator Blowdown[H]	Daily Grab Sample[I]	Weekly Composite[F,G]	Principal Gamma Emitters[C]	5×10^{-7}
			I-131[L]	1×10^{-6}
			Ce-144	5×10^{-6}
2. Service Water Effluent	Monthly Grab Sample	Monthly	Dissolved and Entrained Gases[K]	1×10^{-5}
3. Turbine Building Sumps[H]	Weekly Grab or Composite	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[J,L]	1×10^{-7}
	Weekly Composite	Quarterly Composite[F,G]	Sr-89[J], Sr-90[J]	5×10^{-8}
			Fe-55[J]	1×10^{-6}

TABLE C-2 (Cont'd.)

TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as μCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided. If the steam generator bulk can not be recirculated prior to batch discharge, samples will be obtained by representative compositing during discharge.

C. The LLD will be 5×10^{-7} μCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall also be measured, but with an LLD of 5×10^{-6} uCi/ml.

TABLE C-2 (Cont'd.)

TABLE NOTATIONS

This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

D. For the Condensate Polishing Facility (CPF) - Waste Neutralization Sump and steam generator bulk, these analyses are only required if the applicable batch gamma activity is greater than 5×10^{-7} µCi/ml.

E. For the Condensate Polishing Facility (CPF) - Waste Neutralization Sump: tritium sampling and analyses is only required if there is detectable tritium in the steam generators. Remaining sampling and analysis is required if the steam generator gross gamma activity (sampled and analyzed three times per week per *Table 4.7-2* of the *Technical Specifications*) exceeds 1×10^{-5} µCi/ml.

F. For Batch Releases and Steam Generator Blowdown only, a composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

G. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

H. For the Steam Generator Blowdown and the Turbine Building Sump: tritium sampling and analyses is only required if there is detectable tritium in the steam generators. Remaining sampling and analysis is required when the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-2* of the *Safety Technical Specifications*) exceeds 5×10^{-7} µCi/ml.

I. Daily grab samples shall be taken at least five days per week. For service water, daily grabs shall include each train that is in-service.

J. For the Service Water, these analyses are only required if a weekly gamma analysis indicates a gamma activity greater than 5×10^{-7} µCi/ml.

K. LLD applies exclusively to the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

L. When the Turbine Building sump release pathway is directed to yard drains, the LLD for I-131 shall be 1.5×10^{-7} uCi/ml and for gross alpha 1×10^{-8} uCi/ml.

Table C-3

MILLSTONE 3

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Batch Release[B]				
1. Condensate Polishing Facility - Waste Neutralization Sump[E]	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
			Dissolved and Entrained Gases[K]	1×10^{-5}
2. Waste Test Tanks, Low Level Waste Drain Tank, Boron Test Tanks and Steam Generator Bulk	Prior to Each Batch	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[D]	1×10^{-7}
	Prior to Each Batch	Quarterly Composite[F,G]	Sr-89[D], Sr-90[D]	5×10^{-8}
			Fe-55[D]	1×10^{-6}
B. Continuous Release				
1. Steam Generator Blowdown[H]	Daily Grab Sample[I]	Weekly Composite[F,G]	Principal Gamma Emitters[C]	5×10^{-7}
			I-131[L]	1×10^{-6}
			Ce-144	5×10^{-6}
	Monthly Grab Sample	Monthly	Dissolved and Entrained Gases[K]	1×10^{-5}
2. Service Water Effluent	Weekly Grab or Composite	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[J,L]	1×10^{-7}
3. Turbine Building Sumps[H]	Weekly Composite	Quarterly Composite[F,G]	Sr-89[J], Sr-90[J]	5×10^{-8}
			Fe-55[J]	1×10^{-6}

TABLE C-3 (Cont'd.)

TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal. For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as μCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided. If the steam generator bulk can not be recirculated prior to batch discharge, samples will be obtained by representative compositing during discharge.

C. The LLD will be 5×10^{-7} μCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall also be measured, but with an LLD of 5×10^{-6} μCi/ml. This list does not mean that only these nuclides are to be detected.

TABLE C-3 (Cont'd.)

TABLE NOTATIONS

and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

D. For the Condensate Polishing Facility (CPF) - Waste Neutralization Sump and steam generator bulk, these analyses are only required if the applicable batch gamma activity is greater than 5×10^{-7} μCi/ml.

E. For the Condensate Polishing Facility (CPF) - Waste Neutralization Sump: tritium sampling and analyses is only required if there is detectable tritium in the steam generators. Remaining sampling and analysis is required when the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7*-1 of the *Safety Technical Specifications*) exceeds 1×10^{-5} μCi/ml.

F. For Batch Releases and Steam Generator Blowdown only, a composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

G. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

H. For the Steam Generator Blowdown and the Turbine Building Sump: tritium sampling and analyses is only required if there is detectable tritium in the steam generators. Remaining sampling and analysis is required when the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7*-1 of the *Safety Technical* Specifications) exceeds 5×10^{-7} μCi/ml. Steam Generator Blowdown samples are not required when blowdown is being recovered.

I. Daily grab samples shall be taken at least five days per week. For service water, daily grabs shall include each train that is in-service.

J. For the Service Water, these analyses are only required if a weekly gamma analysis indicates a gamma activity greater than 5×10^{-7} μCi/ml.

K. LLD applies exclusively to the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

L. When the Turbine Building sump release pathway is directed to yard drains, the LLD for I-131 shall be 1.5×10^{-7} uCi/ml and for gross alpha 1×10^{-8} uCi/ml.

C.2 Liquid Radioactive Waste Treatment

a. Dose Criteria for Equipment Operability Applicable to All Millstone Units

The following dose criteria shall be applied separately to each Millstone unit.

1. **IF** the radioactivity concentration criteria for the Unit 3 steam generator blowdown is exceeded with blowdown recovery not available to maintain releases to as low as reasonabley achievable; or,
   IF any of the other radioactive waste processing equipment listed in Section b are not routinely operating, **THEN** doses due to liquid effluents from the applicable waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section C.5 of the ODCM.
2. **IF** any of these dose projections exceeds 0.006 mrem to the total body or 0.02 mrem to any organ, **THEN** best efforts shall be made to return the inoperable equipment to service, or to limit discharges via the applicable waste stream.
3. **IF** an actual dose due to liquid effluents exceeds 0.06 mrem to the total body or 0.2 mrem to any organ, **AND** the dose from the applicable waste stream exceeds 10% of one of these limits, **THEN** prepare and submit to the Commission a Special Report within 30 days as specified in Section c.

b. Required Equipment for Each Millstone Unit

Best efforts shall be made to return the applicable liquid radioactive waste treatment system equipment specified below for each unit to service or to limit discharge via the applicable waste stream if the projected doses exceed any of the doses specified above.

1. Millstone Unit No. 1

Waste Stream	Processing Equipment
Waste collector	Filtration
	Waste demineralizer A or B
Floor drains	Filtration/ion exchanger OR Waste collector equipment (filtration and demineralizer)

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Clean liquid	Deborating ion exchanger (T11) OR Purification ion exchanger (T10A or T10B)
	Primary demineralizer (T22 A or B)
	Secondary demineralizer (T23)
Aerated liquid	Demineralizer (T24) OR Equivalent demineralizer

3. Millstone Unit No. 3

Waste Stream	Processing Equipment or Radioactivity Concentration
High level	Demineralizer filter (LWS-FLT3) and Demineralizer (LWS-DEMIN2) OR Demineralizer (LWS-DEMIN1) and Demineralizer filter (LWS-FLT1)
Boron recovery	Cesium ion exchanger (DEMIN A or B)
	Boron evaporator (EV-1)
Low level	High level processing equipment
Steam generator blowdown	Blowdown recovery when total gamma activity exceeds 5E-7 uCi/ml or tritium activity exceeds 0.02 uCi/ml.

C. Report Requirement For All Three Millstone Units

If required by Section a(3), prepare and submit to the Commission a Special Report within 30 days with the following content:

- Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,
- Action(s) taken to restore the inoperable equipment to OPERABLE status, and
- Summary description of action(s) taken to prevent a recurrence.

GASEOUS EFFLUENTS

D.1 Gaseous Effluent Sampling and Analysis Program

Radioactive gaseous wastes shall be sampled and analyzed in accordance with the program specified in **Table D-1** for Millstone Unit No. 1, **Table D-2** for Millstone Unit No. 2, and **Table D-3** for Millstone Unit No. 3. The results of the radioactive analyses shall be input to the methodology of the ODCM to assure that offsite dose rates are maintained within the limits of *Radiological Effluent Control (Section III) D.2.1* for Millstone Unit No. 1 and within *Technical Specification 3.11.2.1* for Millstone Unit Nos. 2 and 3.

Table D-1

MILLSTONE 1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/cc)
A. Steam Jet Air Ejector Discharge	Monthly - Gaseous Grab Sample[C]	Monthly	Principal Gamma Emitters[B]	1×10^{-4}
B. Main Stack	Monthly - Gaseous Grab Sample	Monthly	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}
	Continuous[D]	Weekly Charcoal Sample[F]	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
	Continuous[D]	Weekly Particulate Sample[F]	Principal Particulate Gamma Emitters[B] - (I-131, Others with half lives greater than 8 Days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}

TABLE D-1 (Cont'd.)

TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in *Table Notations, Item a*, of *Tables C-1, C-2, or C-3*.

B. For gaseous samples, the LLD will be 1×10^{-4} µCi/cc and for particulate samples, the LLD will be 1×10^{-11} µCi/cc. The principal gamma emitters for which these LLDs apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emission and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report*.

C. Sampling and analysis shall also be performed within 24 hours following an increase, as indicated by the steam jet air ejector off-gas monitor, of greater than 50%, after factoring out increases due to changes in THERMAL POWER level.

D. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

E. Analyses for I-133 will not be performed on each charcoal sample. Instead, at least once per month, the ratio of I-133 to I-131 will be determined from a charcoal sample changed after 24 hours of sampling. This ratio, along with the routine I-131 activity determination will be used to determine the release rate of I-133.

F. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing. Special sampling and analysis of iodine and particulate filters shall also be performed whenever subsequent reactor coolant I-131 samples show an increase of greater than a factor of 5 after factoring out increases due to changes in thermal power level. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

Table D-2

MILLSTONE 2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/cc)
A. Batch Release 1. Waste Gas Storage Tank[H]	Prior to Each Tank Discharge	Each Tank Discharge	Principal Gamma Emitters[B]	1×10^{-4}
2. Containment Purge			H-3	1×10^{-6}
B. Continuous Release 1. Vent	Monthly - Gaseous Grab Sample[C]	Monthly[C]	Principal Gamma Emitters[B]	1×10^{-4}
			H-3[G]	1×10^{-6}
	Continuous[D]	Weekly Charcoal Sample[F]	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
	Continuous[D]	Weekly Particulate Sample[F]	Principal Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}
2. Containment Venting	Weekly Grab, if venting[I]	Weekly	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}

TABLE D-2 (Cont'd.)

TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in *Table Notations, Item a,* of *Tables C-1, C-2, or C-3.*

B. For gaseous samples, the LLD will be 1×10^{-4} µCi/cc and for particulate samples, the LLD will be 1×10^{-11} µCi/cc. The principal gamma emitters for which these LLDs apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and XE-138 for gaseous emission and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report.*

C. Sampling and analysis shall also be performed within 24 hours following an unexplained increase, as indicated by the Unit 2 stack noble gas monitor, of greater than 50%, after factoring out increases due to changes in THERMAL POWER levels, containment purges, or other explainable increases.

D. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

E. Analyses for I-133 will not be performed on each charcoal sample. Instead, at least once per month, the ratio of I-133 to I-131 will be determined from a charcoal sample changed after 24 hours of sampling. This ratio, along with the routine I-131 activity determination will be used to determine the release rate of I-133.

F. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing. Special sampling and analysis of iodine and particulate filters shall also be performed whenever subsequent reactor coolant Dose Equivalent I-131 samples, which are taken two to six hours following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour, show an increase of greater than a factor of 5. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant Dose Equivalent I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

G. Grab samples for tritium shall be taken weekly whenever the refueling cavity is flooded and there is fuel in the cavity. The grab sample shall be taken from the stack (Units 1 and 2) where the containment ventilation is being discharged at the time of sampling.

H. Waste Gas Storage Tanks are normally released on a batch basis. However, for the purpose of tank maintenance, inspection, or reduction of oxygen concentration, a waste gas tank may be continuously purged with nitrogen provided the following conditions are met:

(1) The previous batch of radioactive waste gas has been discharged to a final tank pressure of less than 5 PSIG.

TABLE D-2 (Cont'd.)

TABLE NOTATIONS

(2) No radioactive gases have been added to the tank since the previous discharge.

(3) Valve lineups are verified to ensure that no radioactive waste gases will be added to the tank.

(3) After pressurizing the tank with nitrogen, a sample of the gas in the tank will be taken and analyzed for any residual gamma emitters and tritium prior to initiation of the nitrogen purge. The measured activity will be used to calculate the amount of activity released during the purge.

I. If the containment air radioactivity increases or decreases by a factor of two compared to the radioactivity at the time of the weekly air sample based on a trend of Radiation Monitors RM8123 and RM8262 gas channels, a new containment air sample shall be taken.

Table D-3

MILLSTONE 3

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/cc)
A. Batch Release 1. Containment Drawdown 2. Containment Purge	Prior to Each Purge or Drawdown[H]	Each Purge or Drawdown	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}
B. Continuous Release	Monthly - Gaseous Grab[C]	Monthly[C]	Principal Gamma Emitters[B]	1×10^{-4}
			H-3[G]	1×10^{-6}
1. Unit 3 Ventilation Vent	Continuous[D]	Weekly Charcoal Sample[F]	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
2. Engineered Safeguards Building	Continuous[D]	Weekly Particulate Sample[f]	Principal Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
3. Containment Vacuum System and Gaseous Radwaste[I]	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}

TABLE D-3 (Cont'd.)

TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in *Table Notations, Item a*, of *Tables C-1, C-2, or C-3*.

B. For gaseous samples, the LLD will be 1×10^{-4} µCi/cc and for particulate samples, the LLD will be 1×10^{-11} µCi/cc. The principal gamma emitters for which these LLDs apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and XE-138 for gaseous emission and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the *Annual Radioactive Effluent Report*.

C. Appropriate sampling and analysis shall also be performed within 24 hours following an unexplained increase, as indicated by the Unit 3 ventilation vent noble gas monitor or gaseous radioactive waste monitor, of greater than 50%, after factoring out increases due to changes in THERMAL POWER levels, containment purges, or other explainable increases. (Only applicable to gaseous radioactive waste monitor when gaseous dose exceeds 20% of limit - see Footnote I.)

D. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

E. Analyses for I-133 will not be performed on each charcoal sample. Instead, at least once per month, the ratio of I-133 to I-131 will be determined from a charcoal sample changed after 24 hours of sampling. This ratio, along with the routine I-131 activity determination will be used to determine the release rate of I-133.

F. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing. Special sampling and analysis of iodine and particulate filters shall also be performed whenever reactor coolant Dose Equivalent I-131 samples (which are taken two to six hours following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour per *Table 4.4-4* of the *Safety Technical Specifications)* show an increase of greater than a factor of 5. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant Dose Equivalent I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

G. Grab samples for tritium shall be taken weekly from the ventilation vent whenever the refueling cavity is flooded and there is fuel in the cavity.

H. Subsequent to medical emergencies, for initial determination of isotopic content of the containment air, a Health Physics sample may be used in place of the normal chemistry sample.

I. Only required if Unit 1 or 3 gaseous doses exceed 20% of their limits.

D.2 Gaseous Radioactive Waste Treatment

a. Dose Criteria for Equipment Operability Applicable to All Millstone Units

The following dose criteria shall be applied separately to each Millstone unit.

1. **IF** any of the radioactive waste processing equipment listed in Section b are not routinely operating, **THEN** doses due to gaseous effluents from the untreated waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section D.4 of the ODCM. For each waste stream, only those doses specified in Section D.4 of the ODCM need to be determined for compliance with this section.
2. **IF** any of these dose projections exceed 0.02 mrad for gamma radiation, 0.04 mrad for beta radiation or 0.03 mrem to any organ due to gaseous effluents,
   THEN best efforts shall be made to return the inoperable equipment to service.
3. **IF** actual doses exceed 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ
   AND the dose from a waste stream with equipment not continuously operating exceed 10% any of these limits,
   THEN prepare and submit to the Commission a report as specified in Section c.

b. Required Equipment for Each Millstone Unit

Best efforts shall be made to return the gaseous radioactive waste treatment system equipment specified below for each unit to service if the projected doses exceed any of doses specified above. For the Unit 2 gas decay tanks, the tanks shall be operated to allow enough decay time of radioactive gases to ensure that the dose limits are not exceeded.

1. Millstone Unit No. 1

Waste Stream	Processing Equipment
Radwaste Vent Exhaust	Radwaste ventilation HEPA filters

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Five (5) gas decay tanks
	One waste gas compressor
Ventilation Exhaust Treatment System	Auxiliary building ventilation HEPA filter (L26 or L27)
	Containment purge HEPA filter (L25)
	Containment vent HEPA/charcoal filter (L29 A or B)

3. Millstone Unit No. 3

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Charcoal bed adsorbers
	One HEPA filter
Building Ventilation	Fuel building ventilation filter

c. Report Requirement For All Three Millstone Units

If required by Section a(3), prepare and submit to the Commission a Special Report within 30 days with the following content:

- Explanation of why gaseous radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,
- Action(s) taken to restore the inoperable equipment to OPERABLE status, and
- Summary description of action(s) taken to prevent a recurrence.

RADIOLOGICAL ENVIRONMENTAL MONITORING

E.1 Sampling and Analysis

The radiological sampling and analyses provide measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from plant operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Program changes may be made based on operational experience.

The sampling and analyses shall be conducted as specified in *Table E-1* for the locations shown in *Appendix G* of the ODCM. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment or other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period.

All deviations from the sampling schedule shall be documented in the *Annual Radiological Environmental Operating Report* pursuant to *Section F.1.* It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice (excluding milk) at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathways in questions and appropriate substitutions made within 30 days in the radiological environmental monitoring program.

If milk samples are temporarily unavailable from any one or more of the milk sample locations required by Table E-1, a grass sample shall be substituted during the growing season (Apr. - Dec.) and analyzed for gamma isotopes until milk is again available. Upon notification that milk samples will be unavailable for a prolonged period (>9 months) from any one or more of the milk sample locations required by Table E-1, a suitable replacement milk location shall be evaluated and appropriate changes made in the radiological environmental monitoring program. Reasonable attempts shall be made to sample the replacement milk location prior to the end of the next sampling period. Any of the above occurrences shall be documented in the Annual Radiological Environmental Operating Report which is submitted to the U. S. Nuclear Regulatory Commission prior to May 1 of each year.

Changes to sampling locations shall be identified in a revised table and figure(s) in Appendix G of the ODCM.

If the level of radioactivity in an environmental sampling medium at one or more of the locations specified in *Table E-1* exceeds the report levels of *Table E-2* when averaged over any calendar quarter, prepare and submit to the Commission within 30 days from the end of the affected calendar quarter, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the limits of *Table E-2* to be exceeded. When more than

one of the radionuclides in *Table E-2* are detected in the sampling medium, this report shall be submitted if:

$$\frac{concentration\ (1)}{reporting\ level\ (1)} + \frac{concentration\ (2)}{reporting\ level\ (2)} + \ldots \geq 1.0$$

When radionuclides other than those in *Table E-2* are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the appropriate calendar year limit of the *Radiological Effluent Controls (Section III) D.1.1, D.2.2, or D.2.3* for Millstone Unit No. 1 or *Technical Specifications 3.11.1.2, 3.11.2.2 or 3.11.2.3* for Millstone Unit Nos. 2 and 3. This report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the *Annual Radiological Environmental Operating Report.*

The detection capabilities required by *Table E-3* are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. All analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the *Annual Radiological Environmental Operating Report.*

TABLE E-1

MILLSTONE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1a. Gamma Dose - Environmental TLD	17	Monthly	Gamma Dose - Monthly
1b. Gamma Dose - Accident TLD	18	Quarterly[(a)]	N/A[(a)]
2. Airborne Particulate	8	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual sample if gross beta is greater than 10 times the mean of the weekly control station's gross beta results
3. Airborne Iodine	8	Continuous sampler - weekly canister change	I-131 - Weekly
4. Vegetation	5	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5. Milk	3	Monthly	Gamma Isotopic and I-131 on each sample; Sr-89 and Sr-90 on Quarterly Composite
5a. Pasture Grass	4	Sample as necessary to substitute for unavailable milk	Gamma Isotopic and I-131
6. Sea Water	2	Continuous sampler with a quarterly collection at indicator location. Quarterly at control location - Composite of 6 weekly grab samples	Gamma Isotopic and Tritium on each sample.
7. Bottom Sediment	5	Semiannual	Gamma Isotopic on each sample
8. Fin Fish-Flounder and one other type of edible fin fish (edible portion)	2	Quarterly	Gamma Isotopic on each sample
9. Mussels (edible portion)	2	Quarterly	Gamma Isotopic on each sample
10. Oysters (edible portion)	4	Quarterly	Gamma Isotopic on each sample
11. Clams (edible portion)	2	Quarterly	Gamma Isotopic on each sample
12. Lobsters (edible portion)	2	Quarterly	Gamma Isotopic on each sample

(a) Accident monitoring TLDs to be dedosed at least quarterly.

TABLE E-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/g, wet)	Shellfish[c] (pCi/g, wet)	Milk (pCi/l)	Vegetables (pCi/g, wet)
H-3	20,000[a]					
Mn-54	1,000		30	140		
Fe-59	400		10	60		
Co-58	1,000		30	130		
Co-60	300		10	50		
Zn-65	300		20	80		
Zr-95	400					
Nb-95	400					
Ag-110m			8	30		
I-131	20[b]	0.9	0.2	1	3	0.1
Cs-134	30	10	1	5	60	1
Cs-137	50	20	2	8	70	2
Ba-140	200				300	
La-140	200				300	

(a) 20,000 pCi/l for drinking water samples. (This is 40 CFR Part 141 value.) For non-drinking water pathways (i.e., seawater), a value of 30,000 pCi/l may be used.

(b) Reporting level for I-131 applies to non-drinking water pathways (i.e., seawater). If drinking water pathways are sampled, a value of 2 pCi/l is used.

(c) For on-site samples, these values can be multiplied by 3 to account for the near field dilution factor.

TABLE E-3

MAXIMUM VALUES FOR LOWER LIMITS OF DETECTION (LLD)[a]

Analysis	Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish, Shellfish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
gross beta		1×10^{-2}				
H-3	2000[d]					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	15[c]	7×10^{-2}		1	60[b]	
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-2}	150	18	80	180
Ba-140	60[c]			70		
La-140	15[c]			25		

TABLE E-3 (Cont'd)

TABLE NOTATIONS

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\, S_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda\, \Delta t)}$$

where:

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection (or end of the sample collection period) and time of counting.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified in the Annual Radiological Environmental Operating Report.

b. LLD for leafy vegetables.

c. From end of sample period.

d. If no drinking water pathway exists (i.e., seawater), a value of 3,000 pCi.l may be used.

E.2 Land Use Census

The land use census ensures that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of *Section IV.B.3* of *Appendix I* to *10 CFR Part 50*. The land use census shall be maintained and shall identify the location of the nearest resident, nearest garden*, and milk animals in each of the 16 meteorological sectors within a distance of five miles.

The validity of the land use census shall be verified within the last half of every year by either a door-to-door survey, aerial survey, consulting local agriculture authorities, or any combination of these methods.

With a land use census identifying a location(s) which yields a calculated dose or dose commitment greater than the doses currently being calculated in the off-site dose models, make the appropriate changes in the sample locations used.

With a land use census identifying a location(s) which has a higher D/Q than a current indicator location the following shall apply:

(1) If the D/Q is at least 20% greater than the previously highest D/Q, replace one of the present sample locations with the new one within 30 days if milk is available.

(2) If the D/Q is not 20% greater than the previously highest D/Q, consider direction, distance, availability of milk, and D/Q in deciding whether to replace one of the existing sample locations. If applicable, replacement should be within 30 days. If no replacement is made, sufficient justification should be given in the annual report.

Sample location changes shall be noted in the *Annual Radiological Environmental Operating Report.*

*Broad leaf vegetation (a composite of at least 3 different kinds of vegetation) may be sampled at the site boundary in each of 2 different direction sectors with high D/Qs in lieu of a garden census.

E.3 Interlaboratory Comparison Program

The Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

F. REPORT CONTENT

F.1 Annual Radiological Environmental Operating Report

The *Annual Radiological Environmental Operating Report* shall include summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The report shall also include the results of the land use census required by *Section E.2* of this manual. If levels of radioactivity are detected that result in calculated doses greater than 10CFR50 Appendix I Guidelines, the report shall provide an analysis of the cause and a planned course of action to alleviate the cause.

The report shall include a summary table of all radiological environmental samples which shall include the following information for each pathway sampled and each type of analysis:

(1) Total number of analyses performed at indicator locations.

(2) Total number of analyses performed at control locations.

(3) Lower limit of detection (LLD).

(4) Mean and range of all indicator locations together.

(5) Mean and range of all control locations together.

(6) Name, distance and direction from discharge, mean and range for the location with the highest annual mean (indicator or control).

(7) Number of nonroutine reported measurements as defined in these specifications.

In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in the next annual report.

This report shall include a comparison of dose assessments of the measured environmental results to the calculated effluent results to confirm the relative accuracy or conservatism of effluent monitoring dose calculations.

The report shall also include a map of sampling locations keyed to a table giving distances and directions from the discharge; the report shall also include a summary of the Interlaboratory Comparison Data required by *Section E.3* of this manual.

F.2 Annual Radioactive Effluent Operating Report

The *Annual Radioactive Effluent Report (ARER)* shall include quarterly quantities of and an annual summary of radioactive liquid and gaseous effluents released from the unit in the *Regulatory Guide 1.21 (Rev. 1, June 1974)* format. Radiation dose assessments for these effluents shall be provided in accordance with 10 CFR 50.36a and the *Radiological Effluent Technical Specifications.* An annual assessment of the radiation doses from the site to the most likely exposed REAL MEMBER OF THE PUBLIC shall be included to demonstrate conformance with 40 CFR 190. Gaseous pathway doses shall use meteorological conditions concurrent with the time of radioactive gaseous effluent releases. Doses shall be calculated in accordance with the *Offsite Dose Calculation Manual.* The licensee shall maintain an annual summary of the hourly meteorological data (i.e., wind speed, wind direction and atmospheric stability) either in the form of an hour-by-hour listing on a magnetic medium or in the form of a joint frequency distribution. The licensee has the option of submitting this annual meteorological summary with the ARER or retaining it and providing it to the NRC upon request. The ARER shall be submitted by May 1 of each year for the period covering the previous calendar year.

The ARER shall include a summary of each type of solid radioactive waste shipped offsite for burial or final disposal during the report period and shall include the following information for each type:

- type of waste (e.g., spent resin, compacted dry waste, irradiated components, etc.)
- solidification agent (e.g., cement)
- total curies
- total volume and typical container volumes
- principal radionuclides (those greater than 10% of total activity)
- types of containers used (e.g., LSA, Type A, etc.)

The ARER shall include the following information for all abnormal releases of radioactive gaseous and liquid effluents (i.e., all unplanned or uncontrolled radioactivity releases, including reportable quantities) from the site to unrestricted areas:

- total number of and curie content of releases (liquid and gas)
- a description of the event and equipment involved
- cause(s) for the abnormal release
- actions taken to prevent recurrence
- consequences of the abnormal release

Changes to the *RADIOLOGICAL EFFLUENT MONITORING* and *OFFSITE DOSE CALCULATION MANUAL (REMODCM)* shall be submitted to the NRC as appropriate, as a part of or concurrent with the ARER for the period in which the changes were made.